Chapter 1: SELF QUIZ (pg 63)

TRUE/FALSE:
Indicate beside each number whether the corresponding statement is true (T) or false (F). If it is false, write a corrected version.

1. You toss a ball vertically and step aside. The ball rises and then falls down along the same path to your hand. Since the ball reverses direction, it undergoes two-dimensional motion.

2. The magnitude of the velocity of that same ball just before landing is greater than its magnitude of initial velocity upon leaving your hand.

3. The acceleration of that ball at the top of the flight is zero.

4. The time for that ball to rise equals the time for it to fall.

5. A jogger running four laps around a circular track at 4.5 m/s undergoes motion with constant velocity.

6. The slope of the tangent to a curved line on a position-time graph gives the instantaneous velocity.

7. Megametres per hour per day is a possible unit of acceleration.

8. The magnitude of the acceleration due to gravity at Miami is greater than that at St. John's, Newfoundland.

9. The quadratic formula must be used to solve problems involving the quadratic equation
$v_f^2 = v_i^2 + 2a\Delta d$

10. A model rocket launched in a vacuum chamber at an angle of 45° above the horizontal, undergoes projectile motion.

11. If $v_{AB} = 8.5m/s[E]$, then $v_{BA} = -8.5m/s[W]$

MULTIPLE CHOICE: Beside each number, write the letter corresponding to the best choice.

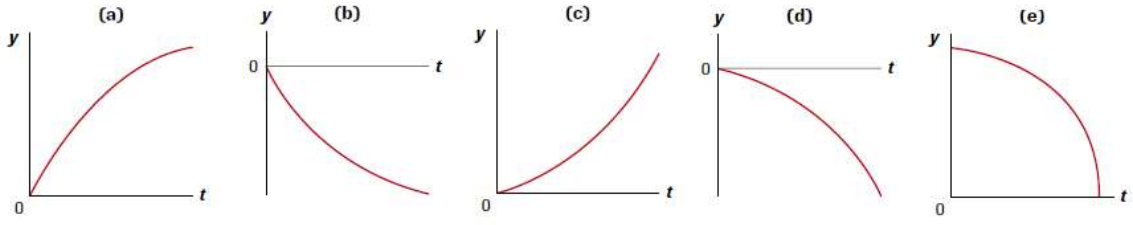

Figure 1
Graphs of vertical position as a function of time for questions 12–15

13. You drop a rubber stopper from your hand: the initial position is your hand, and $1y$ is upward. Which graph in **Figure 1** best represents the relationship?

14. You toss a ball directly upward: the initial position is your hand, and $1y$ is downward. Which graph in **Figure 1** best represents the relationship?

15. You release a cart from rest at the top of a ramp: the initial position is at the top of the ramp, and $1y$ is up the ramp. Which graph in **Figure 1** best represents the relationship?

16. A car with an initial velocity of 25 m/s [E] experiences an average acceleration of 2.5 m/s^2 [W] for 2.0×10^1 s. At the end of this interval, the velocity is
(a) 5.0×10^1 m/s [W]
(b) 0.0 m/s
(c) 25 m/s [W]
(d) 75 m/s [W]
(e) 75 m/s [E]

17. An acceleration has an eastward component of 2.5 m/s^2 and a northward component of 6.2 m/s^2. The direction of the acceleration is
(a) [40° E of N]
(b) [50° E of N]
(c) [24° E of N]
(d) [68° E of N]
(e) [68° N of E]

18. You are a fullback running with an initial velocity of 7.2 m/s [N]. You swerve to avoid a tackle, and after 2.0 s are moving at 7.2 m/s [W]. Your average acceleration over the time interval is
(a) 0 m/s^2
(b) 5.1 m/s^2 [45° N of W]
(c) 1.0×10^1 m/s^2 [45° N of W]
(d) 3.6 m/s^2 [S]
(e) 5.1 m/s^2 [45°W of S]

19. A tennis ball is thrown into the air with an initial velocity that has a horizontal component of 5.5 m/s and a vertical component of 3.7 m/s [up]. If air resistance is negligible, the speed of the ball at the top of the trajectory is
(a) zero
(b) 3.7 m/s
(c) 5.5 m/s
(d) 6.6 m/s
(e) 9.2 m/s

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8. A golfer drives a golf ball 214 m [E] off the tee, then hits it 96 m [28° N of E], and finally putts the ball 12 m [25° S of E]. Determine the displacement from the tee needed to get a hole-in-one using (a) a vector scale diagram and (b) components. Compare your answers.

9. Determine the vector that must be added to the sum of $\vec{A}+\vec{B}$ in **Figure 1** to give a resultant displacement of (a) 0 and (b) 4.0 km [W].

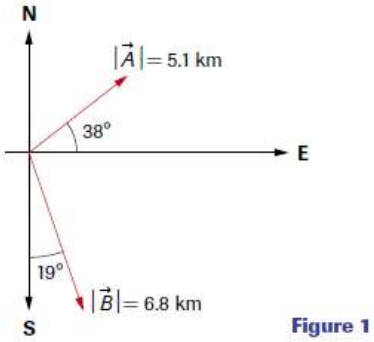

Figure 1

16. Over a total time of 6.4 s, a field hockey player runs 16 m [35° S of W], then 22 m [15° S of E]. Determine the player's (a) resultant displacement and (b) average velocity.

24. An airplane, travelling initially at 240 m/s [28° S of E], takes 35 s to change its velocity to 220 m/s [28° E of S].What is the average acceleration over this time interval?

27. Figure 4 shows a velocity-time graph for a squirrel walking along the top of a fence.
(a) Draw the corresponding acceleration-time graph of the motion.
(b) Draw the corresponding position-time graph from 0.0 s to 1.0 s. (Be careful: for the first 0.50 s, this graph is not a straight line.)

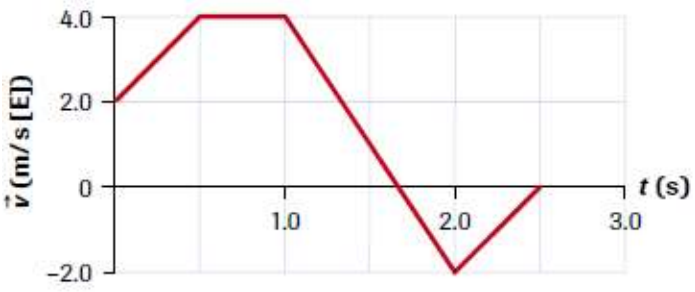

Figure 4

29. (a) What are the horizontal and vertical components of the acceleration of a projectile?
(b) How would your answer change if both components of the motion experience air resistance?

30. A child throws a snowball with a horizontal velocity of 18 m/s directly toward a tree, from a distance of 9.0 m and a height above the ground of 1.5 m.
(a) After what time interval does the snowball hit the tree?
(b) At what height above the ground will the snowball hit the tree?
(c) Determine the snowball's velocity as it strikes the tree.

31. Determine the initial velocity of a projectile that is launched horizontally, and falls 1.5 m while moving 16 m horizontally.

32. You are standing in a train moving at constant velocity relative to Earth's frame of reference. You drop a ball to the floor. What is the path of the ball (a) in your frame of reference and (b) from the frame of reference of a person standing stationary beside the train?

33. A plane is travelling with an air speed of 285 km/h [45° S of E]. A wind is blowing at 75 km/h [22° E of N] relative to the ground. Determine the velocity of the plane relative to the ground.

34. A swimmer who can swim at a speed of 0.80 m/s in still water heads directly across a river 86 m wide. The swimmer lands at a position on the far bank 54 m downstream from the starting point. Determine
(a) the speed of the current
(b) the velocity of the swimmer relative to the shore
(c) the direction of departure that would have taken the swimmer directly across the river

35. The displacement from London, UK, to Rome is 2.5×10^3 km [18° S of W]. A wind is blowing with a velocity of 85 km/h [E]. The pilot wants to fly directly from London to Rome in 5.3 h. What velocity relative to the air must the pilot maintain?

36. A football is placed on a line 25 m from the goal post. The placement kicker kicks the ball directly toward the post, giving the ball an initial velocity of 21.0 m/s [47° above the horizontal]. The horizontal bar of the goal post is 3.0 m above the field. How far above or below the bar will the ball travel?

49. Derive an equation for the horizontal range of a projectile with a landing point at a different altitude from its launch point. Write the equation in terms of the initial velocity, the acceleration due to gravity, the launch angle, and the vertical component of the displacement.

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1. F
2. F
3. F
4. T
5. F
6. T
7. T
8. F
9. F
10. T
11. F
12. (a)
13. (d)
14. (b)
15. (d)
16. (c)
17. (e)
18. (e)
19. (c)

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1. (a) 27.8 m/s
   (b) 3.5×10^2 km/h
2. (a) $L \times T^{-1}$
   (b) $(L/T^3) \times T$
   (c) $(L/T^2) \times T \times T$
8. (a) and (b) 3.1×10^2 m [7.4° N of E]
9. (a) 7.0 km [28° N of W]
   (b) 11 km [18° N of W]
10. (a) about 2×10^3 m [down] (assuming that people are sitting down to dinner)
    (b) approximately 0 m (assuming people are asleep in beds and beds have random directions)
11. 52.426 m/s
12. (a) 64 m
    (b) about 13 car lengths (assuming 1 car is 5 m)
13. (a) 1.2×10^2 s
    (b) 21 m/s
15. (a) 2.3 m/s
    (b) 1.6 m/s [33° below the horizontal]
16. (a) 17 m [29° E of S]
    (b) 2.7 m/s [29° E of S]
18. (a) 0.53 km
    (b) 2.4 (km/h)/s
19. (a) 21 m/s^2 [fwd]
    (b) 25 m/s
    (c) $2.1\,|\vec{g}|$
20. 1.0×10^5 m/s^2 [fwd]
21. 533 m/s [fwd]
22. 6.1 m/s [up]
23. (a) 16 s
    (b) 12 s
24. 3.9 m/s^2 [53° W of S]
25. 54 m/s [E]
26. 0.34 s and 3.1 s
28. (a) 3.50×10^4 m/s; 1.26×10^5 km/h
    (b) 2.23×10^4 m/s
    (c) 1.02×10^{-2} m/s^2
30. (a) 0.50 s
    (b) 0.3 m
    (c) 19 m/s [15° below the horizontal]
31. 29 m/s [horizontally]
33. 2.6×10^2 km/h [60° E of S]
34. (a) 0.50 m/s
    (b) 0.94 m/s [downstream, 58° from the near shore]
    (c) upstream, 51° from the near shore
35. 5.5×10^2 km/h [15° S of W]
36. 8.9 m above
38. (a) 5.2° above the horizontal
    (b) 0.89 m/s^2
40. (a) 2.0 min
41. (a) 0.87 s
46. 62 m/s
47. (a) 2.9×10^2 m
    (b) 16 s
48. (a) [7.5° W of S]
    (b) 14 s
50. 2.0 km/h